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TO STUDY THE EFFECT OF BMI AND WORK EXPERIENCE ON FOOT POSTURE INDEX IN NURSE - AN OBSERVATIONAL STUDY

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Abstract: Between 30%-50% individual spends 4 to 5 hrs in standing, but in nursing professionals spending 10-12hrs in standing position is not uncommon. Standing for long period of time causes increases fatigue and muscle soreness in muscles. Continuous pressure on feet causes bone misalignment and joint degeneration. Functional variance and minimal biomechanical alteration in ankle and foot complex in turns alter the contact with surface area Obesity has been associated with an increased risk of work-related musculoskeletal injuries and foot. The extra weight puts a tremendous amount of pressure on the foot. This physical adaptation leads to impaired balance, abnormal gait and muscle weakness. Individual exhibit flatter feet, associated with reduced inversion-eversion range of motion. The FPI-6 was developed by Redmond A.C in 1998 which provide quantitative measurement of typical deviation of foot posture and is sensitive enough to detect any structural dysfunction in fore foot, midfoot, and rear foot in frontal, sagittal, transverse plane. Methodology: Subjects will be allocated in to 3 groups based on their work experiences. Group A will include nurses with work experience of 1-5 years, Group-B includes nurses with experience of 6-10 years and Group-C will include nurses with experience of 11-15 years. Subjects were divided into 3 categories into their respective groups according to their Body Mass Index (BMI). Group1 will include subjects with normal BMI (18.5-24.9), Group -2 will include subject which are overweight (25-29.9) and Group -3 will include subjects which are obese (>=30) and FPI-6 was taken. Result: It is concluded from the present study that there was no statistically significant difference on FPI-6 in nurses considering BMI and years of work experience. BMI does show weak correlation with FPI so clinically subjects with higher BMI showed chances of getting pronated feet. Discussion: The current study showed no correlations between effect of long-standing hours of working and body mass index on Foot posture body composition may be a confounding factor in interpreting footprint-based estimates of arch height. Increased contact area of arch indicates that it's due to fat deposition rather than structural failure. Indeed, it has been suggested previously that footprint parameters are a measure of "fat feet" rather than "flat feet"

Keywords: foot posture Index-6, Body mass index, Nurses

1.INTRODUCTION

The foot (pleural feet) is an anatomical structure found in many vertebrates. It is the terminal portion of limb which bears weight and allows locomotion. The human foot and ankle are strong and complex structure containing 26 bones and 33 joints and more than 100 muscles, ligaments, tendons.

The foot can be subdivided into hind foot, midfoot and forefoot. Hind foot is composed of talus and calcaneum. Hind foot has cuboid, navicular, and three cuneiform bones which forms the arches of foot. The midfoot has, the cuboid, navicular, and three bones, form the which serves as a shock absorber is connected to hind and fore foot by muscles and plantar fascia. The fore foot is composed of five toes corresponding to five proximal long bones forming metatarsus.

Due to their improper position, function and abnormal foot alignment many medical problems arise such as Painful feet and other foot problems, Plantar Fasciitis and Heel Spurs, Orthopaedics changes in the feet (e.g. flat feet), Increased chance of arthritis in the knees and hips.[1]

Prolonged standing places stress on foot. Standing all day can be detrimental to person's body according to "Canadian Centre for Occupational health and safety." A worker is considered to be exposed to prolonged standing if he/she spends over 50% total working time in standing position. Standing for long period of time causes increases fatigue and muscle soreness in muscles.[2] Continuous pressure on feet causes bone misalignment and joint degeneration. Functional variance and minimal biomechanical alteration in ankle and foot complex in turns alter the contact with surface area.

A number of physiological, biomechanical and environmental factors have been proposed as contributing factors for the development of foot and lower limbs discomfort. The physiological and biomechanical factors include—prolonged standing, swelling, muscle fatigue, foot pressures and foot postures. The environmental factors include footwear, fatigue mats, flooring. Long periods of standing and walking are associated with foot-lower limb discomfort.[3]

Every individual spends 4to 5 hours per day in standing. Professional who spends hours in standing are workers working in the manufacturing and service industries, which include, retail sales associates, industrial workers (machine operators and assembly-line workers), supermarket workers (especially cashiers), and food services staff. Others such as casino dealers, mail carriers, large scale laundering workers, teachers and healthcare workers, but nurses spend generally spends 10 to 12 hrs of shifts in standing.[4]

Work related MSDs are disorders that are worsened or prolonged by work activity, as well as disorders that solely arise from work performance or the influence of the work environment.10 Anecdotal evidence from clinicians and workers suggest that foot and lower limb MSD are relatively common consequences of work that involves prolonged standing or walking. According to a study prevalence of MSD in nurses are of lower back (61.9%), feet and ankles (38.1%), knees (37.1%), neck (36.9%), upper back (35.8%), and the shoulders (32.6%).

Individual risk factors such as obesity and number of self-reported foot conditions (curled toes, flat feet) were strongly associated with the likely hood of experiencing foot problems. Some researches shows that spending more than 30% of total day time on feet increases the risk of significant foot discomfort and spending more than 50% of the day is threshold for foot and lower-limb symptoms.[5] These foot problems showed consistent association with disability and foot discomfort. Some are work related risk factors such as assuming awkward posture, prolonged period of standing particularly nurses in ICU and theatre.

The Body Mass Index is the most common method to quantify weight across a range of body sizes in adults. The BMI is an inexpensive and easy to use clinical measure that can be administered with minimal training. The person's BMI affect the foot posture of individual.[6]

Obesity is a major global health issue. More research is needed to fully define the structural and functional limitations imposed by overweight and obesity, but available studies suggest that increased bodyweight does interfere with normal musculoskeletal function through a variety of kinetic and kinematic impairments. Obesity has been associated with an increased risk of work-related musculoskeletal injuries of foot. This physical adaptation leads to impaired balance, abnormal gait and muscle weakness. Individual exhibit flatter feet, associated with reduced inversion-eversion range of motion.

Studies focusing on general health among nurses have been focused. Limited researches have evaluated the impact of prolonged standing on foot posture index amongst nurses

There is validated method for quantifying standing posture called "foot posture index". The FPI-6 was developed by Redmond A.C in 1998 which provide quantitative measurement of typical deviation of foot posture and is sensitive enough to detect any structural dysfunction in fore foot, midfoot, and rear foot in frontal, sagittal, transverse plane.[7]

FPI-6, a revised version of FPI, was derived from the original eight-item scale. In the new version, two items were removed due to lack of unidimensionality. FPI-6 is said to have moderate to good inter-rater (0.62 to 0.91) and intra-rater (0.81 to 0.91) reliability as well as instrument validity (64%) in measuring foot posture. The FPI-6 has been subjected to evaluation against the Rasch statistical model. This analysis confirms the construct validity of the six-item instrument and the linearity of the metric out.

The FPI-6 is a novel method of rating foot posture using set criteria and a simple scale. It is a measure of standing foot posture and so is not a replacement for gait assessment where time and facilities exist. It is however a more valid approach than many of the static weightbearing and non-weightbearing goniometric measures currently used in clinic.

2. Need of study

The risk of work-related musculoskeletal disorders is high among various healthcare professionals. The standing working position makes the worker more productive and consequently contributes to high productivity 18-20. However, when nurse spent a long period of time in standing position throughout their working hours, they may feel discomfort and experienced muscle fatigue at the end of workday. In the long terms, they will potentially experience occupational injuries. A worker is considered to be exposed to prolonged standing if he/ she spent over fifty percent of the total working hours during a full work shift in standing position. Working in standing position for a long period of time has been recognized as a vital contributor to decrease worker's performance. It includes occupational injuries, productivity decrement, increased of treatment and medical costs, and demoralizes workers. Obesity alters gait, causing the foot to pronate and increases pressures exerted beneath the foot. Some research indicates that increased contact area of the arch may be partly related to deposition of fat rather than arch collapse. With flattening of arch various other problems such as plantar fasciitis (heel spurs) hallux valgus (bunion/Achilles tendonitis) corns, calluses and hammer toes, navicular apophysitis, medial knee pain and patellofemoral dysfunction (improper tracking of the knee cap), hip pain, low back pain. Therefore, it is necessary to conduct a study on effect work experience and BMI on foot posture index hence to increase awareness of musculoskeletal disorders due to their profession and to make them aware about consequences of prolonged standing. Also to create awareness of harmful effect of long standing and to highlight its preventive measures.

3.AIM OF STUDY

To study the effect of Body mass index and work experience on foot posture index in nurses.

OBJECTIVE OF STUDY

To study the effect of Body mass index on foot posture index in nurses.

To study the effect of work experience on foot posture index in nurses.

To compare different groups of Body mass index and work experience on foot posture index in nurses.

4.MATERIAL AND METHODOLOGY

STUDY DESIGN

An observational study was conducted to find out the effect of BMI and work experience on foot posture index in nurses. An observational study was conducted using 130 nurses within age group of 20-45 years of working nurses across hospitals in Surat. Outcome measure: Foot posture index was taken. It is a validated method for quantifying standing posture. The FPI-6 provide quantitative measurement of typical deviation of foot posture and is sensitive enough to detect any structural dysfunction in fore foot, midfoot, and rear foot in frontal, sagittal, transverse plane.

SOURCE OF DATA
This study was carried out at various hospitals of Surat

SAMPLE DESIGN
Convenient sampling was done

SAMPLE SELECTION
Nurses/subjects were selected as per the inclusion and exclusion criteria.

INCLUSION CRITERIA

Female nurses working in general hospitals where they have rotatory duties, who are willing to participate and have working job of standing for minimum-6hrs/day or 24hrs/week with Working experience of 1-15years. And Age group of 20-45years.

EXCLUSION CRITERIA

Nurse with any previous injury to knee and ankle also nurse who are working as matrons. Subjects with congenital foot deformity or having any neurological disorder or any swelling or soft tissue injury near ankle. Nurses who were pregnant or having academic jobs were excluded.

MATERIAL REQUIRES:
Assessment form
Consent form
Data collection sheet
Pen, pencil, eraser, paper
Ruler
Weighing scale
Stadiometer
Digital camera

PROCEDURE:
All the nurses were taken from various hospital of Surat. All the participant's height and weight measurement were taken and the BMI was calculated and according to WHO classification divided into three groups (Normal, Overweight, Obese) Then they were allocated in to 3 groups based on their Working Experiences. Group A included nurses with Working Experience of 1-5 years, Group-B included nurses with Experience of 6-10 years and Group-C included nurses with Experience of 11-15 years. Again, the subjects were sub-divided into 3 groups into their respective groups according to their Body Mass Index (BMI). Group-1 include subjects with normal BMI (18.5-24.9), Group -2 includes subject which are overweight (25-29.9) and Group -3 include subjects which are obese (>=30). FPI-6 was taken.
Statistical Analysis: The demographic data of the participants was analyzed using frequency analysis as data was in categories. To check normal distribution Shapiro-Wilk test was used. As data was not normally distributed non parametric test was used. Kruskall walis test was used. Statistical Analysis was done using SPSS version 29.0. The level of significance was kept "$p<0.05$."

5.RESULT
The reporting of the effect of BMI and work experience on Foot Posture Index was analysed by using proper non-parametric test with 95% confidence interval for all statistical parameters ($p<0.05$). The effect of BMI and work experience was recorded through FPI-6 scale. Statistical analysis was done using SPSS software version 20 Microsoft excel 2007. Total 130 participants were recruited in the study from different hospitals of Surat, based on inclusion and exclusion criteria.

5.1 DISTRIBUTION OF PARTICIPANTS ACCORDING TO BMI

BMI	NO. OF SUBJECTS	% OF SUBJECTS
Normal (18.5-24.9)	63	48.46%
Over weight (25-29.9)	43	33.07%
Obese (≥30)	24	18.47%
Total	130	100%

5.2DISTRIBUTION ACCORDING TO DURATION OF WORK EXPERIENCE OF PARTICIPANTS

Duration of work experience	No. Of subjects	% of subjects
1-5 years	55	42.30%
6-10years	31	23.84%
11-15years	44	33.84%
Total	130	100%

Table 5.3 shows the comparison between Work Experience groups. Kruskall Wallis test was used to compare between 3 groups. (Group A: 1-5 years), (Group B: 6-10 years) and (Group C: 11-15years). The result showed no statistically significant difference in Work Experience as $p>0.05$ indicating there was no effect of Work Experience on foot posture. **Table5.3**

Experience			KW Statistics	p Value
1 – 5 Years	6 – 10 Years	11 – 15 Years		
3.55±2.21	3.81±2.44	3.86±2.51	0.373	0.830

Table5. 4 shows the comparison between BMI groups. Kruskall Wallis test was used to compare between 3 groups. (Group 1: Normal), (Group B: Overweight) and (Group C: Obese). The result showed no statistically significant difference in BMI groups as $p>0.05$ indicating there was no effect of BMI on Foot Posture Index, but clinically the result showed that overweight subjects have effect on Foot Posture Index.

BMI			KW Statistics	p-Value
Normal	Overweight	Obese		
3.30±2.33	4.23±2.25	3.88±2.51	4.11	0.128

6.Discussion

Long standing jobs places stresses on the foot. Nurse's job involves 12hrs of standing jobs especially while in ICU and theater. The prolong stress places muscle weakness and fatigue as result there is change in bony alignment and change in the axis of the joints. Each body part is compressed by all of the section of the body above it e.g.: the head compress the arm, torso compress the hip, but feet are compressed by the weight of the body.FPI-6 is a scale to evaluate the foot in three plane and it is the most reliable tool used now-a-days. It gives a clear picture if there is dominance of motion occurring in one of the three body planes.

The present study is the documentation of the effect of BMI and Work Experience on Foot Posture Index. The study was gender specific including only female.

Kruskall Wallis test was applied to study the effect of BMI which showed no statistical significant difference of BMI on FPI. According to **Wearing HC et al** suggested from his pilot study body

composition influences arch index values in overweight and obese subjects. Consequently, body composition may be a confounding factor in interpreting footprint-based estimates of arch height. Increased contact area of arch indicates that it's due to fat deposition rather than structural failure. Indeed, it has been suggested previously that footprint parameters are a measure of "fat feet" rather than "flat feet".[10]

Kruskall Wallis test was applied to study the effect of Work Experience which showed no statistical significant difference of BMI on FPI. According to **Deepak B. Anap** et al who did study on Work related musculoskeletal disorders among hospital nurses in rural Maharashtra with mean age of 31 years and mean work experience of 11 years concluded that prevalence rates of WMSDs was highest in the low back (48.2%), followed by the shoulder (34.6%), neck (33.1%) and knee (29%). Other regions with less prevalence were thoracic (10.5%), **feet and ankle (7.6%),** elbow (1.88%) and hip (1.6%).[9]

7.Limitations.

1.Sample population was restricted to Surat city.

2.Unequal distribution of subjects in each group.

3Gender specific study.

8.Conclusion:

It is concluded from the present study that there was no statistical significant difference on FPI-6 in nurses considering BMI and years of work experience. BMI does show weak correlation with FPI so clinically subjects with higher BMI showed chances of getting pronated feet.

9. Source of funding

NIL

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